Safety & Mission Assurance News

Mission Success Starts With Safety

June 2001

Take Care of Yourself

--Frederick D. Gregory, Associate Administrator for Safety and Mission Assurance

The work we do is important. Through our efforts, we protect the public, astronauts and pilots, the NASA workforce, and high-value equipment and property. The NASA Administrator depends on the SMA community to make sure our programs and projects are as safe as they can be.

The work is important, but not so important that you should sacrifice your health to get it done. I'm seeing too many health problems, too many injuries, and too many sudden deaths among the NASA workforce. I think we need to step back and consider how to take better care of ourselves.

None of us are getting any younger, but we're working harder and getting less healthy. Increased workloads coupled with reduced staffs have increased on-the-job stress levels. Job-related stress too often carries over into private life, straining families and personal relationships and contributing to poor health. Stress brought home prevents us from unwinding, relaxing, and spending time with our families. We burn out, our weight and blood pressure go up, other health problems appear, and life becomes less satisfying. This is no way to live.

Employees need to take care of their health - physical, mental, family, and social. Get some exercise. Get regular medical checkups, and follow up if problems appear. Take a vacation. Spend quality time with your family and friends. Refresh, recharge, and renew yourself. Use the support and counseling services that NASA offers.

Supervisors need to keep an eye on their employees, and themselves, too. If employees become overstressed or ill, direct them to professional help. Encourage the responsible use of sick leave, vacation time, and credit hours. The job is never so important that health and family should suffer.

We care about NASA employees because they are people - our friends and co-workers. But we also care because ill, injured, or overstressed employees can't perform well - if they're on the job at all.

Take care of yourself.

Make a Difference- Add Value

--Michael A. Greenfield, Deputy Associate Administrator for Safety and Mission Assurance

Want to be seen as "value-added," to make a difference? Want to be the person who saved your program or project from ultimate failure? (That *would* be pretty special!) Then extend your vision. Look at the "big picture." And look into the future to identify risks that are not yet problems. This is the initial step of risk management. Risk management is proactive. It is also just plain *good management*. Managing risks is much more effective than dealing with problems. Problems are risks that have already occurred and dealing with them can only be seen as reactive.

Risks are events that *could* happen (they are uncertain or probabilistic), they would have some adverse (maybe even catastrophic) consequence if they happened, and there is still time to do something about them—time to research them, mitigate them, accept them, or simply continue to watch them. Risks can relate to technical, performance, or programmatic areas like cost or schedule. To identify risks, ask, "what could go wrong?" in all of these areas and attempt to answer the question. It might help to do some simple qualitative fault trees (and fault trees *can help* in all of the areas of interest, including the programmatic area). What are the top-level undesirable events that must be avoided in your program or project? What "basic events" can lead to these top-level events? Analyze them. How likely are they? How severe would the consequences be if the risk occurred? Is there still time to do something about them? If so, these are your risks.

> Need some help with fault trees? Download the U.S. Nuclear Regulatory Commission's "Fault Tree Handbook" as a PDF file at: http://www.nrc.gov/NRC/NUREGS/SR0492/index.html.

And don't stop at merely identifying and analyzing risks—that's just not a complete job. Take the extra step—think risk mitigation. Propose solutions that will benefit the program or project. As appropriate, review your proposed solutions with engineering or resources people: are they

See "Risk", p. 7

Risk Based Acquisition Management (RBAM): Hate the name, but love the result

--Phil Napala

RBAM is a procurement initiative that incorporates continuous risk management requirements into the NASA acquisition process.

How many times have we complained that the SMA community was not involved at the very beginning of a program or project? Time and time again, it seemed as though projects were well underway before risks and safety and assurance principles were seriously considered. RBAM fixes this in a direct basic way: follow the money. Procurement rules work differently than safety and mission assurance rules. In procurement, you must follow all the steps or you can't spend any money. So, we tied continuous risk management to getting the money.

What drives RBAM is Procurement Notice 97-58, a November 2000 change to the NASA Federal Acquisition Regulation (FAR) Supplement. The NASA FAR Supplement is more stringent than NASA Policy Directives (NPD's) or NASA Procedures and Guidelines (NPG's): violations of the NASA FAR Supplement have criminal penalties.

PN 97-58's main thought is simple. Program/project risks must be discussed and evaluated throughout the acquisition process. Specifically, technical, schedule, cost, environmental and health, safety, security, resource (including personnel expertise), and unauthorized technical transfer risks must be considered. Once considered and identified, these risks shall be quantified as high, medium, or low during each acquisition phase. The results are typically shown on an acquisition stoplight chart, using red for high risk, yellow for medium, and green for low risk.

The disciplined continuous risk management process that we are all familiar with is used to manage risk throughout the acquisition cycle:

- **Identify**. Sit individuals down, and point out trouble areas.
- **Analyze**. Engage brain, preferably before buying.
- **Plan**. Before leaping, think about where you'll land.
- **Track.** Keep tabs on your bets.
- **Control**. Try not to do really stupid things.
- **Communicate**. Be real when telling managers about risks.
- **Document**. Write it down and don't forget.

To make it easier for everyone, we created specific RBAM tools and devices. All these tools and devices are available free of charge at the Glenn Research Center Risk Management web page:

http://www.grc.nasa.gov/WWW/spaceiso/rbam

The primary tool is the RBAM worksheet. The worksheet can be used to start identifying program/project risk. The worksheet is really a checklist to identify possible trouble spots. The RBAM worksheet is a collection of general risk areas and mitigation strategies developed by acquisition teams at NASA Centers. Using this checklist will result in a good first-cut risk list categorized in the risk areas spelled out in PN 97-58. After the first cut, the process can vary, but these risks can be presented at the formal Acquisition Strategy Meeting, or become source selection official backup material that supports award approval.

How does RBAM help the SMA community? Most of NASA's acquisitions should have overall low safety and mission assurance risk. Inherent risk may be high, but application of normal, solid, well-defined processes can satisfactorily mitigate risk areas. This is where the SMA community can be invaluable. Imbedded into RBAM, the safety and mission assurance disciplines can be used to mitigate major risks. Assurance programs can be added to the Statement of Work to inspect, audit the risk areas, or to reliably test risky technical design solutions. In other cases, hazard analyses, quality parts programs, and surveillance programs can be invoked to further reduce possible dangerous conditions.

RBAM ties the money process to the safety and mission assurance process. Early application is showing practical benefit. Risks are being identified before announcements are published. Risk discussions required by PN 97-58 have been healthy reality checks as new, innovative, and technically challenging NASA project acquisitions come up for review.

The NASA EEE Parts Assurance Group

--Michael J. Sampson, GSFC Code 306, and Jeannette Plante, Dynamic Range

NASA's technology advancement is leading to evermore sophisticated and autonomous spacecraft. Advances are largely based on smaller, faster, more functional electronic devices. Sophisticated software that makes the spacecraft largely autonomous runs on these electronics. Electronics are the nervous system of the spacecraft, the memory, the senses, the "intelligence." For the spacecraft to function properly, all of its electronic parts must function properly.

The goal of electrical, electronic, and electromechanical (EEE) parts assurance efforts is to ensure a dependable supply of highly functional and reliable EEE parts to NASA projects. This responsibility has traditionally been discharged by a combination of commodity specialists and project support engineers. The project parts engineers (PPEs) call on the commodity specialists for detailed parts reliability information, application guidance and assistance in performing failure investigations, and finding alternative sources of supply or substitute devices.

NASA recently realized that retirements and other personnel actions had significantly drained the Agency's pool of commodity specialists. To reinvigorate EEE parts assurance processes across the Agency, OSMA formed the NASA Electronic Parts Assurance Group (NEPAG) in 2000 with the support of the Office of the Chief Engineer (OCE). NEPAG is developing methods and tools to make the most efficient use of the Agency's parts engineering resources and maintain core parts engineering competencies.

NEPAG is managed out of Goddard Space Flight Center under the leadership of Michael J. Sampson. Primary support comes from the lead parts engineers at ARC, JSC, MSFC, LaRC, GRC, KSC, and JPL. NEPAG also leverages off of partnerships with various Department of Defense organizations that have parallel and complementary efforts and requirements for high reliability parts in space systems. Representatives of the European Space Agency and the National Space Development Agency of Japan provide input for issues of global interest, such as the reliability of commercial parts in space and the drive towards the use of lead-free solders and plating for electronic systems.

See "NEPAG", p. 8

Nondestructive Evaluation Working Group Supports NASA Programs

NASA's Nondestructive Evaluation (NDE) program is sponsored by OSMA and managed by LaRC with guidance from the NASA Nondestructive Evaluation Working Group (NNWG). The NDE program provides a focus for new NDE technology initiatives, documentation requirements, and cost-effective operating practices and processes to promote NASA safety and mission assurance. The NDE program is showing clear benefits to NASA programs and operations.

For example, KSC is working to improve composite NDE capability for accurate and precise detection of structural defects in bonded composites for Space Station and Shuttle hardware. Improvements will solve the recurring problem of ambiguous or incomplete NDE inspection results in composites. Priority applications are composite Flight Crew System (FCS) components that replace metal components, and Spray-on Foam Insulation (SOFI) material for the external tank. Inspections on FCS pallets revealed internal defects that had no visible external indications, and identified the need for redesign of some components and changed ground processing procedures. KSC and JSC are initiating a program requirement for inspection using these advanced NDE techniques.

MSFC and KSC are evaluating shearography techniques to inspect bonding between insulation and the Shuttle's external tank. Results will demonstrate shearography's sensitivity and accuracy to detect disbonds as well as provide an implementation strategy for each Center's shearography applications.

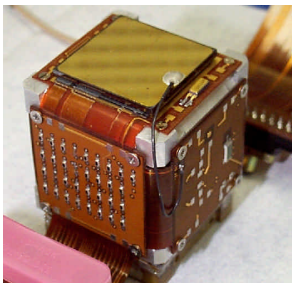

Figure 1: InFOCuS apparatus works better and costs less thanks to an NNWG program

GSFC is developing NDE techniques to screen bulk quantities of cadmium zinc telluride that will be used in X-ray detectors for the International Focusing Optics Collaboration for μCrab Sensitivity (InFOCuS) program. Two techniques were developed to correlate bulk defects to detector performance, leading to a nine-fold increase in production yield and improved detector quality.

See "NNWG", p. 7

2001 George M. Low Awards Presented

NASA Administrator Dan Goldin presented the 2001 George M. Low Awards at the 16th Annual NASA Continual Improvement and Reinvention Conference on May 10, 2001, in Alexandria, VA. The George M. Low Award is the premier quality and performance award in the aerospace industry. The award signifies NASA's recognition that the recipient has demonstrated excellence and outstanding achievements in quality and performance. The award is based on:

- Performance and Customer Satisfaction
- Schedule Performance
- Cost Performance
- Management Response to NASA's Goals
- Leadership and Continuous Improvement
- Innovation and Technology Breakthroughs
- Items of Special Interest to NASA

Award winners must excel in each area. Winners were named in three categories:

- Large Business, Service
- Small Business, Product
- Small Business, Service

Raytheon ITSS, Lanham, MD, nominated by Ames Research Center, Goddard Space Flight Center, and the Jet Propulsion Laboratory, received the 2001 George M. Low Award in the large business, service category.

Raytheon ITSS has a superior performance record, energetic management, and a commitment to outstanding performance. All three Centers highly endorsed Raytheon ITSS. The ITSS group has made considerable strides adapting to Raytheon's culture since being purchased from Hughes in 1998. Raytheon ITSS has been able to focus on customer needs through their 6 Sigma philosophy. The result is a focused contractor that makes the right cost control decisions while meeting their customer's expectations.

Swales Aerospace, Beltsville, MD, nominated by Goddard Space Flight Center, received the 2001 George M. Low Award in the small business, product category.

Swales is an outstanding small business of approximately 1000 employees. The company's mission is to "provide world class engineering and systems solutions to our customers in a cost effective and responsive manner with professionalism and integrity." Swales has contracts with GSFC, JPL, and LaRC. Employees own 57% of Swales through an Employee Stock Ownership Program. Recent major deliverables to NASA include:

- The integrated EO-1 spacecraft,
- Multi-segmented Mars Deep Drill demonstration unit for JPL,
- FUSE telescope assembly, and
- 21-foot long integrated radiator/heat-pipe panel for the ISS.

Native American Services, Inc. (NAS), Huntsville, AL, nominated by Marshall Space Flight Center, received the 2001 George M. Low Award in the small business, service category

NAS is an onsite small disadvantaged business servicing MSFC's Materials, Processes, and Manufacturing (MPM) Department. NAS performs exceptional work operating the Materials Combustion Research Facility and maintaining the Materials and Processes Technical Information System. NAS has 27 full-time employees and was recently sold to Integrated Concepts & Research Corporation.

Left to Right: Dr. Ashok Kaveeshwar, Senior Vice President of Raytheon ITSS; Elmer Travis, President of Swales Aerospace; Dr. Lajpat Utreja, President of Native American Services; and NASA Administrator Dan Goldin

2000 QASAR Winners Recognized

NASA Administrator Dan Goldin presented four "Best of the Best" Quality and Safety Achievement Recognition (QASAR) awards for 2000 at the 16th Annual NASA Continual Improvement and Reinvention Conference on May 10, 2001, in Alexandria, VA. The QASAR award program promotes quality, safety, and continuous improvement throughout NASA. The award recognizes specific contributors to NASA programs who have demonstrated exemplary performance in contributing to the quality and/or safety of products, services, processes, or management programs and activities. Winners are recognized in four categories:

- NASA Safety and Mission Assurance organization civil servants
- NASA civil servants outside the SMA organizations
- Non-NASA civil servants
- NASA contractors

Centers award local QASAR recognition and nominate one person for the annual "Best of the Best" QASAR Award in each of the four award categories. The QASAR Award Board then selects winners from the Center nominations.

Jerry B. Holsomback of JSC's International Space Station Program Management Office received the award for NASA SMA organization employee. He has provided exceptional SMA leadership since the advent of the International Space Station program, and was instrumental in implementing and directing a probabilistic risk assessment effort. As the focal point for SMA within the ISS Program Management Office, Mr. Holsomback has provided crucial and decisive engineering and management direction to NASA, its contractors, and the International Partners.

Dr. George Sarver, III, of ARC's Systems Development Branch and the Manager, Space Station Biological Research Project (SSBRP), received the QASAR Award for NASA non-SMA civil servant. Dr. Sarver championed the inclusion of accurate and verifiable SMA requirements in the Mission Requirements Document for SSBRP, and authored its first formal Risk Management Plan. Dr. Sarver's distinguished SMA management and technical support significantly reduced risk and increased the probability of mission success for the SSBRP.

Michael A. Pokorski, of the Grand Rapids office of the Defense Contract Management Agency, received the award for non-NASA civil servant. During inspections at a vendor, Mr. Pokorski identified problems with critical hydraulic pumps for the Space Shuttle and recommended checking NASA's inventory, including pumps installed on Atlantis, due for launch in less than a month on STS-106. Two pumps at the vendor's plant and one on Atlantis had the same problems. Mr. Pokorski's actions made significant contributions to the safety of STS-106 and subsequent Shuttle missions.

Dave Sheriff, calibration recall lead for the United Space Alliance at KSC, received the award for NASA contractor. Mr. Sheriff developed calibrations policies and processes to meet ISO 9001 requirements and led an activity to match calibrated tools and instruments to user organizations, track usage, and identify under-used tools and instruments that could be removed from the calibration cycle. Mr. Sheriff's success in reducing the inventory of calibrated tools has saved a minimum of $900,000 per year while reducing the instances where non-calibrated instruments are used for critical measurements or verifications.

The three civil servants each received $10,000 cash awards from NASA. Mr. Sheriff received a cash award from United Space Alliance. For more information on the QASAR program, contact Geoff Templeton on (202) 358-2157 or gtemplet@hq.nasa.gov

Left to right: Dr. George Sarver III, Dave Sheriff, NASA Administrator Dan Goldin, Michael A. Pokorski, and Jerry B. Holsomback

Continual Improvement Teams Present at 16th Annual Continual Improvement & Reinvention Conference

Five Center Continual Improvement (CI) Teams were selected from Center nominations to make presentations at the 16th Annual NASA Continual Improvement and Reinvention Conference on May 10, 2001, in Alexandria, VA. The CI teams are groups who meet regularly to improve work-related processes or problems by using a structured approach. The team may consist of any mix of NASA civil servants and contractors. The team must demonstrate use of CI principles, techniques, and problem solving/process improvement tools to improve productivity and quality (defects-per-unit, cost, cycle time, communication, and customer satisfaction) through participation and teamwork. The selected teams were:

Dryden Flight Research Center's Hazardous Material Management CI Team

In 1993, DFRC's hazardous waste generation was on the rise, disposal costs were increasing, chemical management was a significant operational burden, and there was a mandate to reduce hazardous waste generation by 50%. Through teaming with internal and external customers and stakeholders, the Safety, Health, and Environmental Office and the Aircraft Maintenance Division developed a strategy that exceeded goals for improving DFRC's chemical management process.

Goddard Space Flight Center's Landfill Gas Utility Service Acquisition Team

As a result of an Executive Order that mandated reduced energy consumption and increased use of renewable sources, Goddard investigated using landfill gas (methane generated by decomposing garbage at a landfill) as the primary fuel for its steam boiler plant. The Acquisition Team determined that there were no notable safety or operating concerns. Using landfill gas will save $1 million per year in heating costs and reduce emissions equivalent to removing 100,000 cars from the roads. Based on these findings, Goddard has switched to landfill gas as its primary boiler fuel.

Johnson Space Center's Space Shuttle Program Process Control Focus Group

The Space Shuttle Program (SSP) Process Control Focus Group (PCFG) addressed increasing process control escapes that plagued the Shuttle program, causing schedule delays and mission problems. The team used CI methods such as root cause analysis, brainstorming, best practices, and sharing lessons learned to understand the problems and develop techniques for improvement. The team developed process control standards, an SSP-wide management plan, and an awareness program for suppliers. The PCFG is taking a long-term view to try to influence the culture of Shuttle suppliers and increase process control. A key first-year product is the "Success in Process Control" video giving examples of how minor process control escapes caused major problems. The video also shows how individuals can catch process escapes. The video has been distributed widely to Shuttle suppliers and received enthusiastic and positive feedback.

Kennedy Space Center's Hazardous Materials Management Program Team

In 2000, KSC launched the Hazardous Materials Management Program (HMMP) to evaluate a pilot program at the Corrosion Control Facility, with a specific view towards implementing similar hazardous materials management across KSC. HMMP is addressing opportunities to:

- Reduce the accumulation of expired and damaged containers in storage,
- Minimize excess waste materials,
- Consolidate similar products,
- Evaluate and approve hazardous materials prior to purchase, and
- Provide a structured system to identify pollution prevention opportunities.

Marshall Space Flight Center's Structural Loads Test Measurement Acquisition System Team

The Structural Loads Test Measurement Acquisition System (SLTMAS) is a highly customized data acquisition system supporting structural load testing of flight hardware. The SLTMAS has been used on major flight programs for over 35 years. The SLTMAS Team used continual improvement methods to identify and implement means to improve the system's capacity and capability; reduce upgrade, maintenance, and operations costs; reduce test scheduling and setup times; and speed up data analysis.

The Administrator and senior managers judged MSFC's SLTMAS Team to be the best presentation.

"NNWG", from p. 3

GRC fabricated and tested a prototype silicon carbide (SiC) sensor for hydrocarbons. The sensor demonstrated good sensitivity to propylene and ethylene and improved long-term stability. This sensor will be used to detect fuel leaks, and the technology will be applied to oxides of nitrogen (NOx) and hazardous emission measurements. GRC also built a portable electronic holography system for borescope inspections of vibrating structures. The system uses neural networks to provide real-time damage analysis.

KSC is assessing a variety of helium and hydrogen leak visualization techniques for effectiveness and technology readiness. MSFC used advanced thermal signature methods to test the integrity of electrical wires in a damaged Solid Rocket Booster (SRB) cable bundle, and to identify and locate a leak on a Shuttle main engine nozzle after all other known methods failed.

The NNWG also operates the Agencywide NDE Rapid Response Team (RRT) which provides on-demand, real-time NDE assistance for mission-critical problems. One issue the RRT worked on was evaluating the structural integrity of the Refurbished Manipulator Arm System (RMAS) at JSC after damage caused by a hydraulic failure. The RMAS is a mission critical training system. It

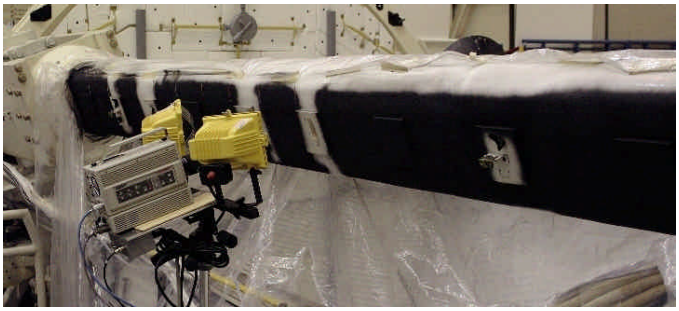

Figure 2: Rapid Response Team's thermal system measuring the RMAS

simulates use of the Shuttle's robotic arm for building the International Space Station. Mission specialists on Station assembly flights spend long hours training on the RMAS. The Rapid Response Team used a thermal measurement system from LaRC as well as ultrasonic spectroscopy and flash thermography systems from MSFC to inspect graphite-epoxy booms in the RMAS. Data from these systems was critical to recertifying the RMAS for use. OSMA funded advanced development of the thermographic inspection systems before they were used on the RMAS.

The Rapid Response Team is available to any NASA program that requires expertise in nondestructive evaluation to solve problems. For more information on the RRT, contact Ed Generazio at (757) 864-4970 or E.R.GENERAZIO@LaRC.NASA.GOV. More information on the NNWG and NDE in general can be found at http://nesb.larc.nasa.gov/nnwg.html.

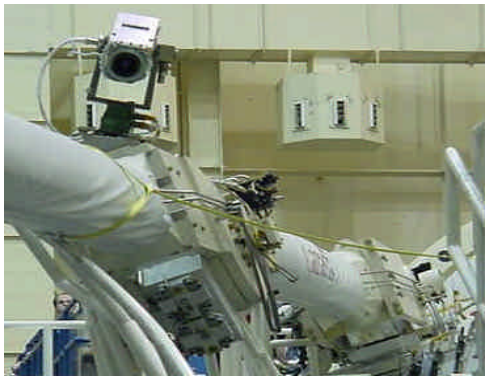

Figure 3: Post incident review, view of RMS elbow joint, looking towards the shoulder joint.

"Risk", from p. 1

likely to work? Are they practical? Can they be done? How soon; how much would they cost? Are they worthwhile? Consider what the risks would be after implementation—hopefully their probability or severity will be much less. If so, take your proposed solutions to program/project management for decision. By extending your vision and taking the extra step to risk mitigation, you can make a real difference. You can add real value. You might even end up a hero!

For safety risks (or hazards), proposed solutions should follow the order of precedence in NPG 8715.3, "NASA Safety Manual;" i.e.,

1. Eliminate hazards.
2. Design for minimum hazards.
3. Incorporate safety devices.
4. Provide caution and warning devices.
5. Develop administrative procedures and training.

"NEPAG", from p. 3

The most effective way to deploy limited resources is to focus on the areas with the most problems and concerns. NASA does not currently have a database to capture such information. NEPAG was able to collect some data, primarily from one Center, showing the value of such a database. Figure 1, a Pareto diagram for the sources of parts concerns from 1991 to 2000, shows the results from one analysis. Seven types of devices represent 88% of the parts issues and should therefore get top priority for our valuable resources. NEPAG has begun to develop a database to capture parts problem experiences across the Agency; the data we have so far shows that parts problems are not decreasing.

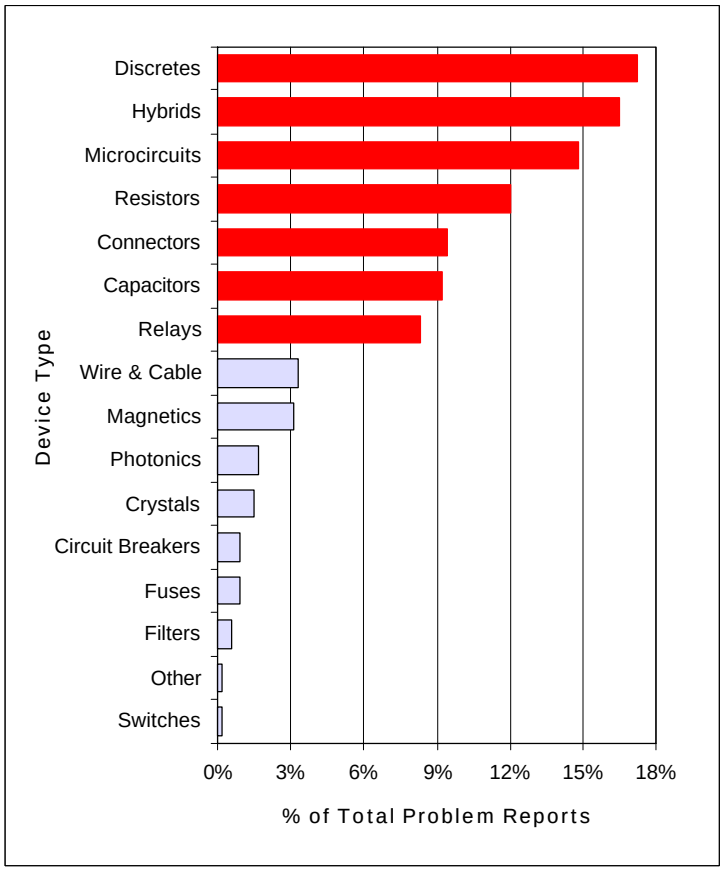

Figure 1: A Pareto Diagram showing the percentage contribution of various EEE parts commodities to the overall rate of parts concerns.

NASA parts engineers need automated tools to improve the efficiency of routine activities such as parts selection, reliability determination, review of historical data, failure investigation, vendor assessment, and information exchange. NEPAG is developing elements for a tool set to address these needs. The key element of this toolkit is the website at http://eee.larc.nasa.gov/forum. The public access segment provides general-use tools such as a risk assessment matrix for various grades of EEE parts. The password-protected area is an interactive system to develop tools and assist EEE parts engineers in their daily activities. Current tools include an informal discussion area, an interactive calendar, and proprietary data such as manufacturer test results, with future plans to add a vendor information database (delivery performance, problem incidences, takeovers mergers, process changes, etc.). The public access area will be expanded as products developed in the protected area are deployed.

NEPAG will celebrate its first birthday in September. We have made a good start but much remains to be done, and major challenges such as the establishment of an Agency-wide EEE parts information database lie ahead. Questions regarding the NEPAG website should be addressed to LaRC/Otis Riggins at (757) 864-7944 or J.O.Riggins@larc.nasa.gov, and general questions about NEPAG should be directed to GSFC/Michael Sampson at (301) 286-3335 or msampson@pop300.gsfc.nasa.gov, or to HQ/Tom Whitmeyer at (202) 358-2228 or twhitmey@hq.nasa.gov.

Find Safety Tips

GRC, KSC, LaRC, MSFC, and Headquarters produce periodic safety tip sheets for Center distribution. The tips are directed at personal, home, and workplace safety. Current and back issues of the safety tip sheets may be found at:

HQ: http://www.hq.nasa.gov/office/codeq/safetytips/index.htm
GRC: http://osat.grc.nasa.gov/safety/ ("Safety Links")
MSFC: http://www1.msfc.nasa.gov/STAR/
KSC: http://aztec.ksc.nasa.gov/ecweb/
LaRC: http://safety.larc.nasa.gov/

OSMA has developed an on-line index of the Center safety tip sheets, sorted by subject area, which includes a link to the source document. Interested employees can search the index for tips in specific areas. Those looking to incorporate safety tips into publications can search the index for existing tips rather than having to develop them from scratch.

The safety tip index can be found at:
http://www.hq.nasa.gov/office/codeq/safety/safetips.htm